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ABSTRACT

Differences in persisting and withdrawing students who entered the University of South Dakota's medical technology program during 1974-1984 were studied to provide information for career counselors. Data were collected for 200 students on high school grade point average (GPA), American College Testing (ACT) program scores, first semester college GPA, final preclinical college GPA, clinical GPA, Strong Vocational Inventory scores, Strong-Campbell Interest Inventory (SCII) scores, and Myers-Briggs Personality Type Indicator (MBTI) scores. It was found that earned GPA and ACT scores were good predictors of continued academic success, a finding also found in past studies. SCII scores did not significantly correlate with academic success, although the clinical laboratory students tended to score high on certain SCII scales. MBTI results confirmed that the clinical laboratory students comprise a varied group of personality types. No relationship between academic performance and personality type was found. No significant differences in personality type were found for persisters and dropouts. The data confirm another finding of past studies: that clinical laboratory science students are a task-oriented group who prefer an orderly way of life. (SW)

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PREDICTING SUCCESS IN THE CLINICAL LABORATORY SCIENCE CURRICULUM

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INTRODUCTION

In recent years a great deal of attention has been focused on the lack of job satisfaction or need fulfillment and increased attrition in the field of clinical laboratory science. Many researchers have focused on this problem and analyzed it from a variety of directions. Many causative factors have been suggested. Included are: over education and underutilization, lack of realistic job and career expectations, lack of recognition and the opportunity for career advancement, ineffective management, and a stressful work environment.

Multiple solutions have been offered. Some suggest that the answer lies in changing the work environment and climate through participative management approaches and by providing greater challenge, responsibility, recognition, and opportunity for professional growth and development. Other suggested solutions involve reducing educational requirements and establishing more specific role expectations and then clearly communicating these to prospective clinical laboratory science students. A great deal of discussion has also emphasized the importance of striving for more effective student admissions procedures which attempt to select individuals who will succeed in the educational program and also find job satisfaction. Although many individuals do find satisfaction within the clinical laboratory science field, it is a great concern that some individuals after expending a great deal of personal effort and resources do not find career satisfaction.

As an educator in the clinical laboratory science field it has become apparent to me that I am a part of this problem and have responsibility in trying to further understand it. One of my primary responsibilities is informing and recruiting prospective students. Another responsibility involves the on-going advising and career counseling of students as they progress through the curriculum. The following quote from one of the first articles written and published in the American Journal of Medical Technology which focused on student selection clearly summarizes this great responsibility:

> Every creature has a special work in life to do. If we can be of any assistance in helping an individual find his or her chosen profession we have done a great charity. On this will rest the health and happiness of the individual.[17]

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REVIEW OF LITERATURE

In reviewing the literature on student selection and admissions the trend throughout the years has been an attempt to find more objective tools and procedures to use in selecting students who have the capability to complete the clinical laboratory science curriculum. As greater numbers of individuals became interested in pursuing a career in this area the pressure grew to select the most capable students. The emphasis was definitely placed on demonstrated intellectual ability and proven academic performance. Selecting students who could successfully complete program requirements was the major goal. However, it has also been recognized by educators in the field that academic criteria have limitations and that an individual's motivation, personality, interests, and values are also critical factors in predicting the potential for a productive career in the clinical laboratory. Over the past thirty years numerous studies have focused on the above factors and have attempted to assess their relationship to predicting the potential success in the clinical laboratory science curriculum.

Many studies have evaluated the use of past academic achievement as a predictor of continued academic success. In general, the studies agree that past academic achievement as demonstrated by earned grade point average (GPA) is the best single predictor of continued academic success.[6,8,9,11,16,22] Numerous studies also looked at the contribution of aptitude testing to the student selection process.[6,8,16,17,21] A variety of aptitude tests have been used by various investigators and in general their usefulness in predicting the academic success of students has been demonstrated. Most studies reported that in comparison to GPA, aptitude test results were not as strong a predictor. Several investigators have stressed the use of multiple predictors and have demonstrated that prediction can be improved by combining GPA with aptitude measurements.[8,16] It should be noted that a shortcoming in many of the studies involved the use of graduation from a program and performance on a certification examination as the criteria for success. Many investigators have pointed to this problem and have stressed the importance of identifying admissions criteria that will predict professional success and satisfaction instead of academic performance. Only one study reviewed utilized success in professional practice as a criteria. This study reported that academic measurements may not be good predictors of clinical performance and success either during the senior clinical year of study or the

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first year of professional practice. The results of the study suggested that two dimensions are involved in student selection and in predicting their success. Academic variables predict academic success and non-academic variables predict clinical success. The investigators stressed that both variables are important in evaluating a student's potential to become a competent self-satisfied practicing technologist.

Several investigations have also looked at the role of interest inventories and their use in predicting student success.[6,10,11,17] These studies reported that medical technology students tend to have interest patterns similar to practicing medical technologists. However, the pattern is only slightly stronger for those who complete the clinical laboratory curriculum in comparison to those students who change their career pathway. In general, the studies concluded that interest inventories were not good predictors of those students who will complete a program and that they should be used only as an adjunct to academic measurements in the student selection process. Another more recent study demonstrated that interest inventory scores do not discriminate interests of students within various allied health careers.[3] Clinical laboratory science students also scored high on several other health-related occupational scales. The same study demonstrated that the scores of clinical laboratory science students increased on the medical technology occupational scale from high school to graduation from the program.

Throughout the years investigators have also looked at personality characteristics as a component of the student selection process and predictor of student success.[6,17] Various personality inventories have been used and in general their value as predictors has been reported to be limited. In recent years the Myers-Briggs Type Indicator (MBTI) has been used in studying personality characteristics of clinical laboratory science students and practitioners as well as students and practitioners in many other health occupations. One study involving clinical laboratory personnel indicated that individuals with different personality types tend to end up in management and education positions in contrast to those who function as clinical practitioners.[7] Studies involving clinical laboratory practitioners and students demonstrated that certain MBTI personality types are found in increased percentages when compared to other health occupations or the population in general.[4,14,19,20] Studies have also

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looked at the relationship between personality types as determined by the MBTI and job satisfaction . Results of these studies are interesting, however, inconclusive. The MBTI has been demonstrated to be a useful tool in student advising and career counseling, however, its usefulness in predicting student success or career satisfaction needs further study.

PRESENT STUDY

This study profiles approximately 200 students who entered the medical technology program at the University of South Dakota between the years of 1974 and 1984 and attempts to identify significant differences in the characteristics of those students who completed the program and those who did not. The goal was to obtain information that would be beneficial in career counseling of prospective high school students and enrolled clinical laboratory science students. The University of South Dakota clinical laboratory science program has an open enrollment policy and students self-select themselves into the program.

The following data was collected: (1) High School GPA, (2) ACT Scores, (3) First Semester College GPA, (4) Final Pre-Clinical College GPA, (5) Clinical GPA, (6) Strong Vocational Inventory Scores, and (7) Myers-Briggs Personality Type Indicator Scores. The data was compiled from student files. The Strong Vocational Inventory and Myers-Briggs Type Indicator are given as part of the career exploration component of a required freshman year course. The data was entered into a computer and statistical analysis was performed using the SAS program.

RESULTS OF STUDY

I. Academic Performance

Academic performance as reflected by earned grade point average (GPA) was analyzed as a predictor of academic success. There was a high correlation between high school GPA and first semester college GPA (r=.57) and final college GPA (r=.58). This would indicate that the high school composite GPA is a strong predictor of academic performance in college. The composite GPA of all incoming high school students in the study was 3.44 on a four point scale. This indicates the high academic potential of the students

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selecting the program. The data also demonstrates no significant difference between entering GPA of those students who complete the program ($\bar{Y}$=3.46) and those who do not complete it ($\bar{Y}$=3.39).

Once a student is enrolled in the clinical laboratory science program, earned GPA continues to be a strong predictor of future academic performance. First semester GPA showed a strong correlation with final pre-clinical college GPA (r=.86). In contrast to high school GPA, there is a significant difference in the GPA earned the first semester of college by those who remain in the program ($\bar{Y}$=3.03) in contrast to those who leave the program ($\bar{Y}$=2.64). It can also be noted that the correlations between high school and pre-clinical college GPA do not correlate as strongly with clinical GPA. The charts below summarize the above findings.

GPA AS PREDICTOR OF ACADEMIC SUCCESS

High School GPA	r
1st Semester College GPA	.57
Final College GPA	.58
Clinical GPA	.45
1st Semester College GPA	
Final College GPA	.86
Clinical GPA	.59

GPA AS PREDICTOR OF GRADUATES AND NONGRADUATES

	Graduates $\bar{Y}$	Nongraduates $\bar{Y}$
High School GPA	3.46	3.39
* No significant difference in GPA between the two groups. (P = .24)		
1st Semester College GPA	3.03	2.65
* Significant difference in GPA between the two groups. (P = .0001)		

II. American College Testing Program

The aptitude measurement used in this study is ACT scores. The ACT is a highly validated test developed by the American College Testing Program. It measures an individual's mental capability and potential. It is usually taken by high school students during their junior year. For the purpose of this study the following ACT scores were analyzed: Composite score, Math score, and Natural Science score. The Composite score for the entire group of students selecting the clinical laboratory science curriculum was 23.66. This is high in comparison to the national norm of 18.7. The mean Math score was 24.39 (national norm 17.3) and mean Natural Science score was 26.01 (national norm 21.1). This data once again demonstrates that a

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very capable group of students select the clinical laboratory science curriculum. In comparing the ACT scores of graduates to those who leave the program (non-graduates) a significant difference exists. The composite mean for those who graduate is 24.7 in contrast to 22.5 for those who do not. The Science score mean is 26.9 for graduates in contract to 25.0 for non-graduates. The Math score mean is 25.7 for graduates and 22.9 for non-graduates. The data also demonstrates that Composite ACT scores are useful predictors of college academic performance. The following correlation coefficient were obtained: first semester GPA (r=.54), final pre-clinical college GPA (r=.57). The correlation with clinical GPA (r=.32) is not as strong. The chart below summarizes the above results.

ACT AS PREDICTOR OF ACADEMIC SUCCESS

ACT Composite	r
1st Semester College GPA	54
Final College GPA	.57
Clinical GPA	.32

ACT AS PREDICTOR OF GRADUATES AND NONGRADUATES

	Graduates $\bar{Y}$	Nongraduates $\bar{Y}$
Composite	24.7	22.5
Math	25.74	22.9
Science	26.9	25.0

* Significant difference in ACT scores between the two groups. (P = .0001)

III. Strong-Campbell Interest Inventory

The Strong-Campbell Interest Inventory (SCII) was used in this study to assess interests. It was developed in the 1920's and designed to differentiate interests of individuals in different occupations. Over the years the inventory has been further developed and revised and it has become one of the most respected and utilized interest inventories. The present form of the inventory consists of six broad occupational theme scales, 22 basic interest scales which represent broad occupational categories, and 57 female and 67 male occupational scales. The greatest use of this inventory is in vocational counseling and in assisting individuals in making career choices. Students can take the inventory and then compare their interests to interest patterns of professionals in a variety of occupations. It is postulated that selecting an occupation congruent with one's interests and the interests of practitioners in that occupation is an important factor in job satisfaction.

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The present study compiled and analyzed graduate and non-graduate scores on the following basic interest scales: Science, Mathematics, Medical Science, and Medical Service. In addition, the scores on the medical technologist scale of the occupational scales were studied. A summary of the data is presented in the chart below. In general, the mean scores on the four basic interest scales studied were high. The scores on the Medical Service scale was the highest. The tendency for clinical laboratory science students to score high in these areas is congruent with the results of past studies.[3,10] The mean score on the Medical Technologist scale can be interpreted as the interests of the students being moderately similar to those of practicing medical technologists.

In comparing the scores of those students who graduated from the program and those who did not, no significant differences in scores were found. This would indicate that the scores are not helpful in predicting students who will complete the program in contrast to those who will not. Similar results were reported in other studies.[11] Finally, it should also be noted that as reported in past studies no significant correlations were found between scores on the SCII and academic performance.

STRONG VOCATIONAL INVENTORY

	Graduates $\bar{Y}$	Nongraduate $\bar{Y}$
Science	56.91	55.55
Math	55.21	51.48
Medical Science	59.01	59.43
Medical Service	64.54	65.93
Medical Technology	43.92 (14-63)	41.64 (13-68)

* No significant difference between the two groups on any of the scores.

* No significant correlations between academic acheivement and any of the scores.

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IV. Myers-Briggs Type Indicator

The Myers-Briggs Type Indicator (MBTI) was selected to use in this study because of its increasing use in assessing personality patterns of practitioners in various health occupations. It is an easy to administer and score inventory. The MBTI was designed by Isabel Briggs Myers to implement Jung's theory of personality type. Jung's theory is based on the premise that apparently random variation in human behavior is actually orderly and consistent, and related to basic personality differences in the way people prefer to use their minds, specifically the way they use perception and judgement. Perception is the process by which an individual becomes aware of things, people, occurrences, or ideas, and judgement is the process used to make conclusions about what has been perceived. The MBTI attempts through a self-report form to ascertain an individual's basic preference in regard to perception and judgement.

The MBTI profiles personality type based on a combination of four different personality preferences: extroversion-introversion; sensing-intuition; thinking-feeling; and judging-perceiving. The first preference (introversion-extroversion) has to do with whether a person focuses on the outer or inner world. The second preference (sensing-intuitive) reflects a person's mode of perception and whether he/she relies on conscious direct sensing or unconscious indirect perceptions. The third preference (thinking-feeling) reflects an individual's way of making decisions and whether he/she relies primarily on objective thinking or on feelings and values. The fourth preference (judgement-perception) determines whether a person's strongest personality feature is the perceptive process (sensing or intuition) or the judging process (thinking or feeling) and reflects the preferred method of dealing with the surrounding world.

MYERS-BRIGGS TYPES INDICATOR

Four Scales

Extroversion ..... Introversion
(Orientation To Life)

Sensing ..... Intuition
(How You Perceive Things)

Thinking ..... Feeling
(How You Make Decisions)

Judgement ..... Perception
(Does Perception S:I or
Judgement T:F Govern)

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A combination of the preference from each of the four scales results in one of 16 possible personality types. They are: ISTJ, ISTP, ESTP, ESTJ, ISFJ, ISFP, ESFP, ESFJ, INFJ, ENFS, INTJ, INTP, ENTP, and ENTJ. A brief description of the four preference scales is given below:

Extroversion-Introversion Scale

E people attend to the outer world of people and things in action, making confident use of trial and error.

I people focus on the inner world of ideas and like to reflect at great length before acting.

Sensing-Intuition Scale

S people tend to be realistic and practical, observant, fun-loving, and good at remembering and working with facts.

N people tend to value imagination, inspirations, and possibilities, are good at new ideas, projects, and problem-solving.

Thinking-Feeling Scale

T people tend to analyze, weigh facts, and think that impersonal logic is a surer guide than human likes and dislikes.

F people tend to sympathize, weigh the personal values, and feel that human likes and dislikes are more important than logic.

Judging-Perceiving Scale

J people live in a planned, decided, orderly way, aiming to regulate and control it.

P people live in a flexible, spontaneous way, aiming to understand life and adapt to it.

Each preference can be considered to be on a scale with 100 in the middle indicating a balance between the two factors such as introversion and extroversion. Moving to one side of the scale is a preference for introversion and the other side extroversion. The strong preferences dominate an individual's personality. For example, an individual who types as an E or extrovert, enjoys extroverting more than introverting and has developed this side of his personality. He enjoys activities allowing for extroversion, and probably would find more satisfaction in an occupation that allows for extroversion.

In this study the MBTI was given to 144 freshmen incoming students who had declared a major in the clinical laboratory science curriculum. Of this group 46 students graduated from the program and 98 did not. On the Intro-

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version/Extroversion Scale the number of I's and E's is almost equal with 51% extroverts and 49% introverts. The mean score on the scale is 99.44. There was no significant difference on this scale between those who remained in the program and graduated (99.95) and those who left the program (99.20). On the Sensing/Intuition Scale, 73% of the students showed a preference for sensing while 27% reported a preference for intuition. The mean score on this scale for all students was 86.73. This shows a definite leaning toward sensing. However, there was no significant difference between those who remain in the program(85.73) and those who did not (87.20). On the Thinking/Feeling Scale, 37% of the students were thinking and 63% feeling. The mean score for the entire group was 105.72 which leans toward feeling. No significant difference was found between graduates (108.52) and drop-outs (104.41). On the Judgement/Perception Scale, 66% of all students were J's and 34% P's. The mean score (89.20) leans toward judgement. Once again there was no significant difference between the two groups; graduates (84.15) and non-graduates (91.58). The following chart summarizes the percent breakdown of personality types of graduates and nongraduates:

Comparison of Myers-Briggs Personality Types

	Graduates (N = 46)	Non-Graduates (N = 98)
ISTJ	6.5	9.1
ISFJ	30.4	14.2
INFJ	2.1	3.0
INTJ	2.1	3.0
ISTP	0.0	1.0
ISFP	4.3	10.2
INFP	6.5	2.0
INTP	2.1	4.0
ESTP	2.1	2.0
ESFP	8.6	8.1
ENFP	4.3	8.1
ENTP	0.0	1.0
ESTJ	13.0	15.3
ESFJ	8.6	12.2
ENFJ	2.1	3.0
ENTJ	6.5	3.0

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A chi-square was run and showed no significant difference between the personality types of graduates and nongraduates. The inventory is apparently not useful in predicting which students will remain in the program and graduate. It is interesting to note that 60.5% of the graduating students have a combination of sensing and judging. This would indicate that they are a task oriented group which prefers an orderly way of existence.

Other studies have used the MBTI in evaluating students in the clinical laboratory sciences. Rezler and French studied a variety of health occupations to look at personality types attracted to various allied health professions and also assess the learning preferences of the various groups of students. A limited number of clinical laboratory science students were tested.[14] Williams also reported a study which included clinical laboratory students from CLA, MLT, and MT programs.[20] The chart below summarizes the results of the two other studies and the present study. Also included is data reported for liberal arts majors. The chart displays the percentages of students falling into each personality preference.

COMPARISON OF MYERS-BRIGGS PERSONALITY TYPES

	College Liberal Arts Majors	Studies of Clinical Laboratory Majors		
Introversion-Extroversion Scale		Knapp	Williams	Renzler/ French
E	58	51%	55%	26.1%
I	42	49%	45%	73.9%
Sensing-Intuition Scale				
S	30	73%	57%	56.5%
I	70	27%	43%	43.5%
Thinking-Feeling Scale				
T	34	37%	31%	43.5%
F	66	63%	69%	56.5%
Judging-Perceptive Scale				
J	45	66%	59%	65.2%
P	55	34%	41%	34.8%

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The data from the various studies involving clinical laboratory students is similar except for the Rezler/French study which reported a higher percent of introverted in comparison to extroverted students. The two other studies report similar percentages and more extroverted students. All three studies report more sensing students in comparison to intuitive; more feeling in comparison to thinking; and also more judging in comparison to perceptive. In contrast to the liberal arts majors there are definitely more sensing and judging clinical laboratory science majors. In summary, although there is a wide variety of personality types within clinical laboratory science majors, there is a tendency for many to be sensing and judging types which indicates that in general they are a task oriented group who prefer an orderly way of existence.

The MBTI has also been used to assess the personality types of practicing laboratory personnel. The data from various studies suggests that there are more introverted, sensing, and thinking practicing clinical laboratory professionals in comparison to the students who are entering the profession. Although there are these minor differences, in general the data indicates that the students being attracted into the field have personality types which are similar to those of practicing laboratory professionals. The data from studies by French and Rezler, Connors, and Williams is summarized below.

COMPARISON OF MYERS-BRIGGS PERSONALITY TYPES

	Studies of Practicing Clinical Laboratory Personnel			
	French	Connors	Williams	
Introversion-Extroversion Scale	(1976)	(1979)	(1975)	(1976)
E	39%	31.9%	43.9%	36.9%
I	61%	68.1%	56.1%	63.1%
Sensing-Intuition Scale				
S	77%	71%	62.2%	62.1%
I	23%	29%	37.8%	37.9%
Thinking-Feeling Scale				
T	55%	47.8%	49.3%	36.3%
F	45%	52.2%	50.7%	63.7%
Judging-Perceptive Scale				
J	71%	73%	65.5%	66.0%
P	29%	27%	34.5%	34.0%

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SUMMARY

This study confirms what many past studies also have indicated that earned grade point average and ACT scores tend to be good predictors of continued academic success. On the other hand, the Strong-Campbell Interest Inventory (SCII) shows no significant correlation with academic success. The study did confirm that clinical laboratory students tend to score high on certain SCII scales and this information is helpful in career counseling, however, it must be interpreted in a very broad way. The Myers Briggs Type Indicator (MBTI) data confirms that clinical laboratory science students comprise a varied group of personality types. There was no relationship found between academic performance and personality type, although the data was limited. There was also no significant personality type difference between students who completed the program and those who did not. The data confirms as past studies have that clinical laboratory science students are a task oriented group who prefer an orderly way of life.

In general, this study tends to raise many more questions than it answers. A major area for further investigation remains the evaluation of the relationship between job satisfaction and student achievement, interests, and personality type. This information is of great interest to those who are involved in the career counseling of students in the field

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